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(71) Applicant(s)
Sumitomo Wiring Systems Limited

(Incorporated in Japan)

1-14 Nishisuehiro-cho, Yokkaichi City, Mie Pref., Japan

(72) Inventor(s)
Naohito Sawamura
Satoshi Amihiro

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GB 1523291 A GB 1413518 A GB 1177275 A

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(74) Agent and/or Address for Service
Mewburn Ellis
York House, 23 Kingsway, LONDON, WC2B 6HP,
United Kingdom

(54) Flat cable harness assembly

(57) In a flat harness assembly, the plural circuits are separated into common circuits (20, 21, 22) that are always used and optional circuits (23, 24, 25) that are used only as required. The common circuits (20, 21, 22) and optional circuits (23, 24, 25) are separately stamped from copper foil, both sides of the circuits are coated with an insulating film (26a, 26b, 27a, 27b), and the circuits are cut apart to complete the harnesses. The separate harnesses (10, 11) may be combined with a common connector to form a single harness according to the electrical system requirements. The flat harness assembly significantly reduces copper foil waste from circuit formation and reduces the size of the die needed for copper foil stamping.

Fig. 1a

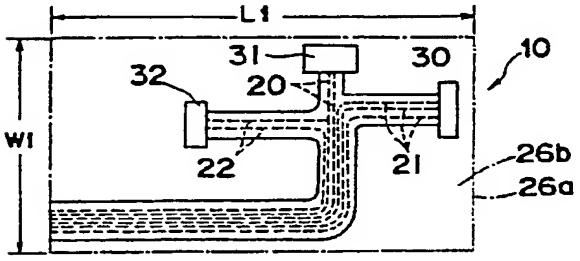

Fig. 1b

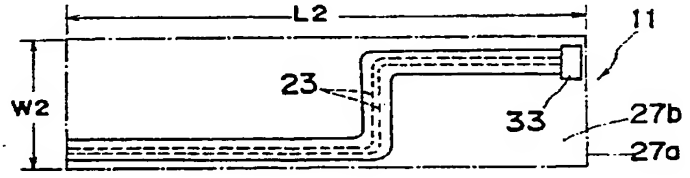

Fig. 1c

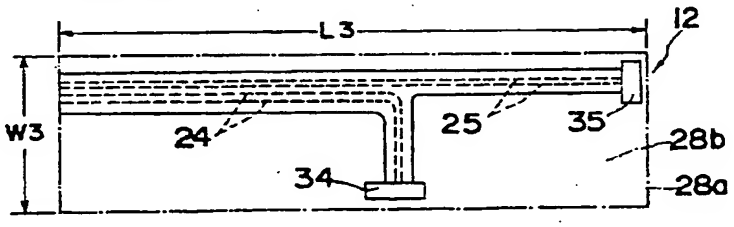

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Fig. 1a

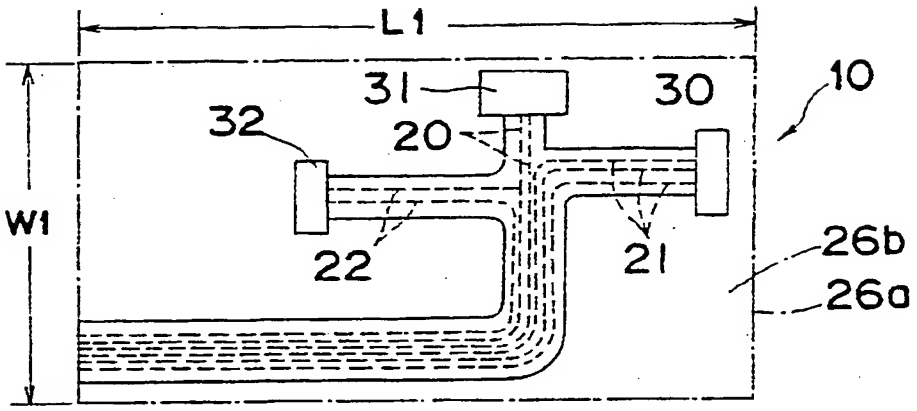

Fig. 1b

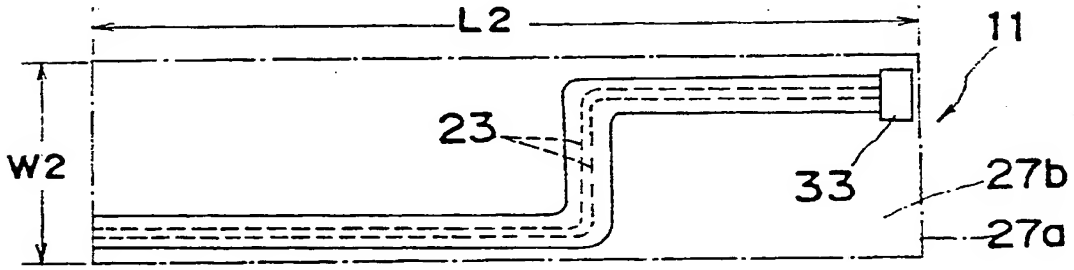

Fig. 1c

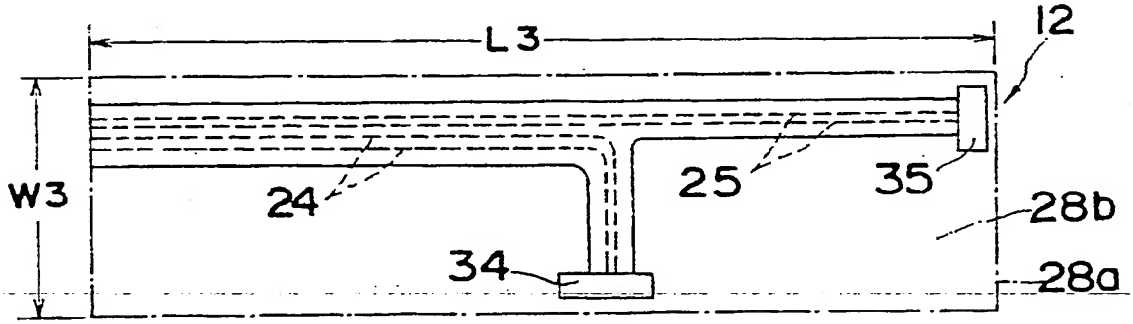

Fig. 2a

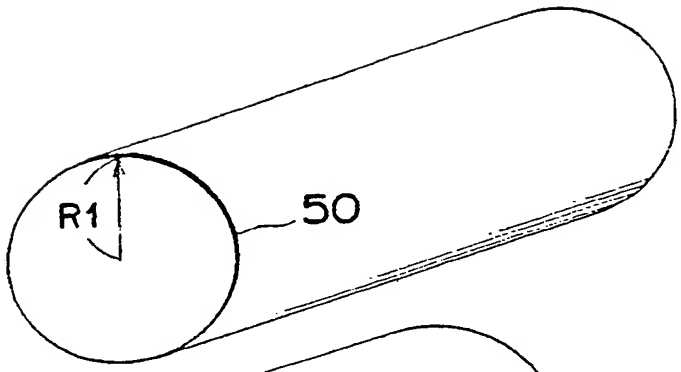

Fig. 2b

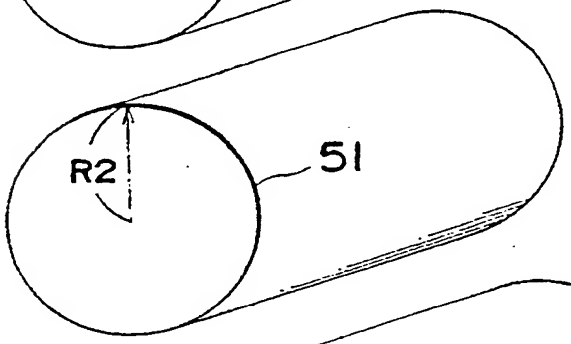

Fig. 2c

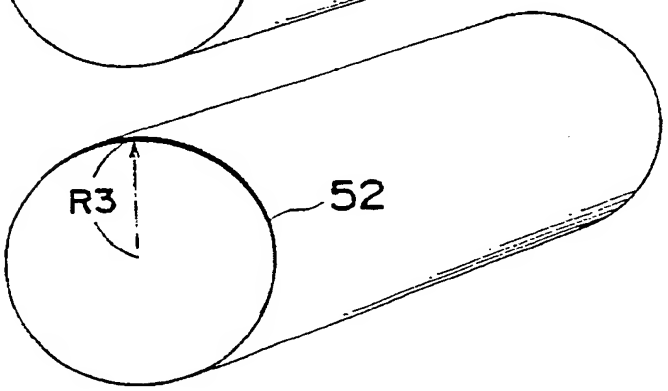

Fig. 3

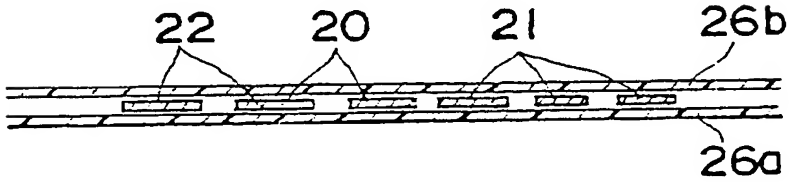

Fig. 4a

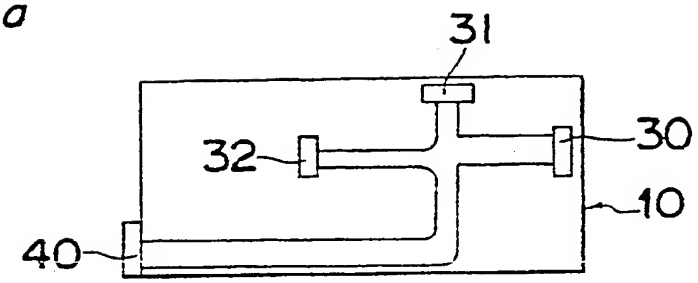

Fig. 4b

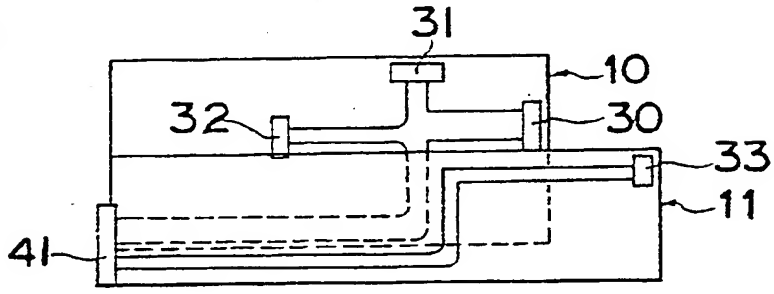

Fig. 4c

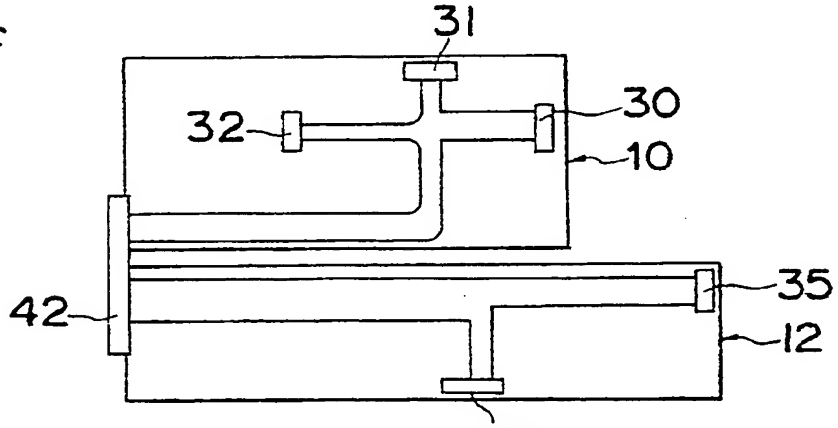

Fig. 4d

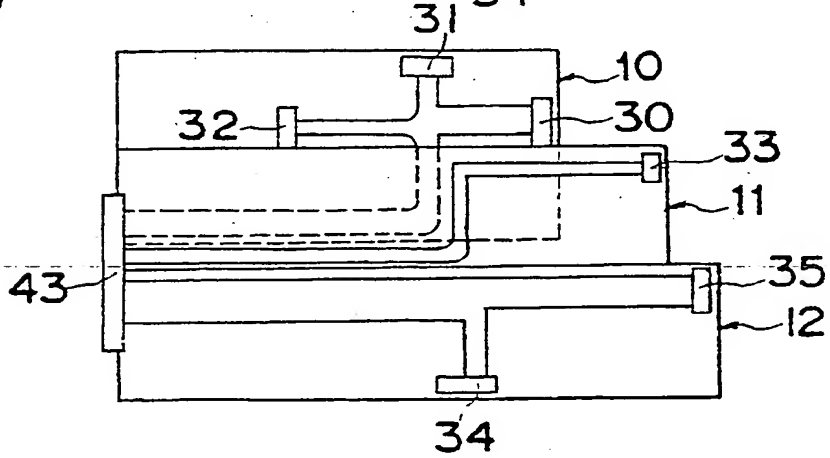

Fig. 5a

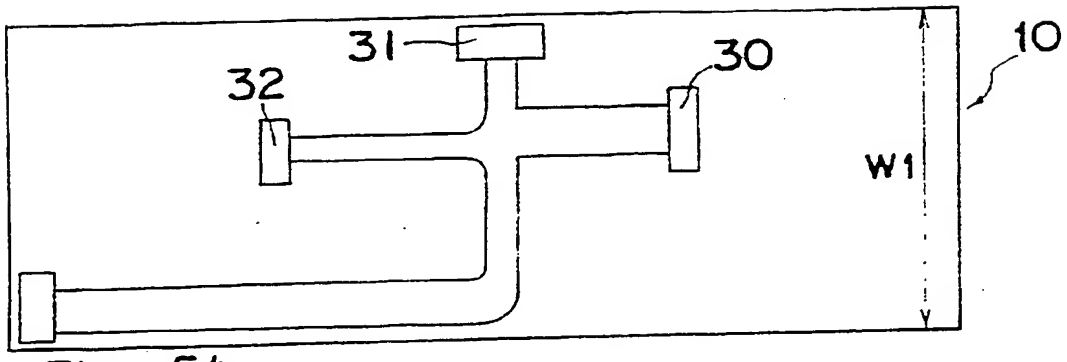

Fig. 5b

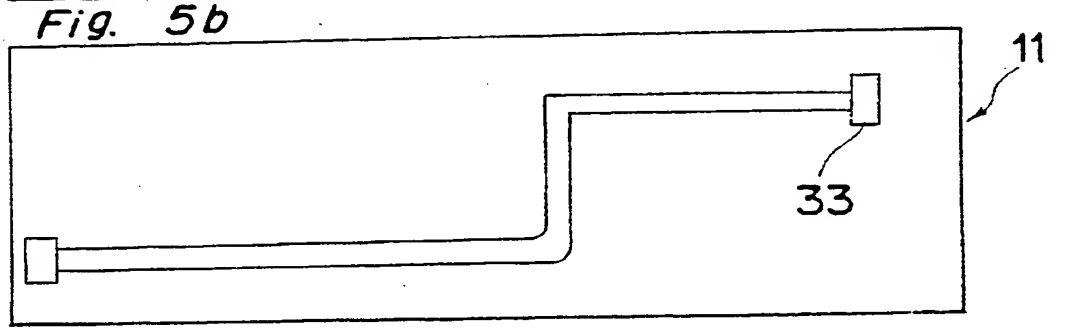

Fig. 5c

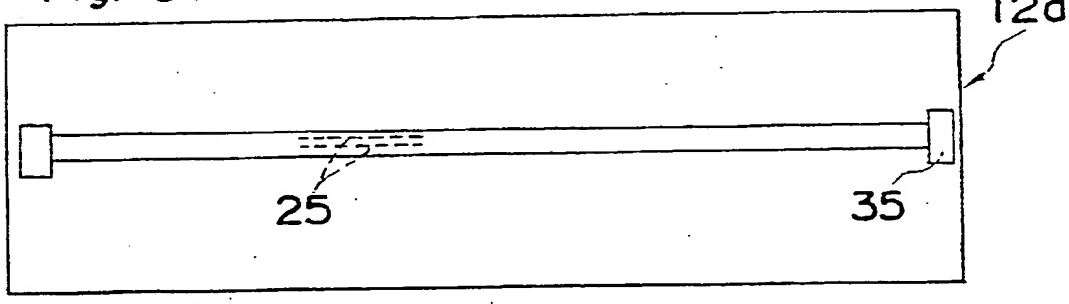

Fig. 5d

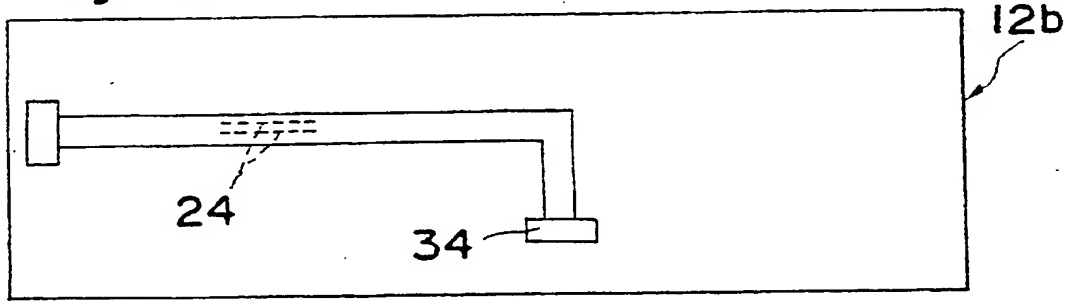

Fig. 6

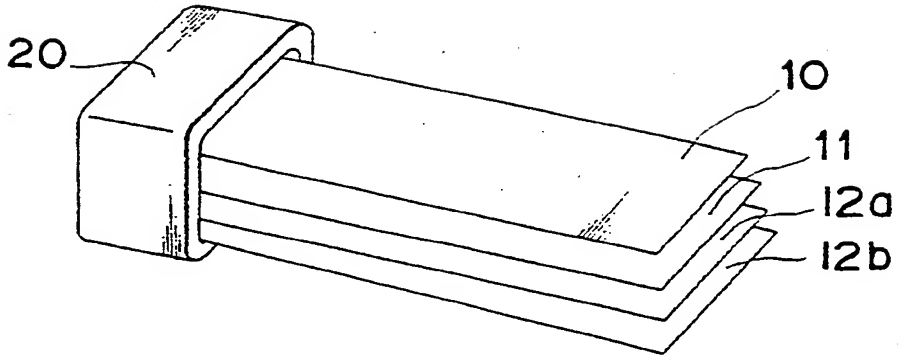

Fig. 7

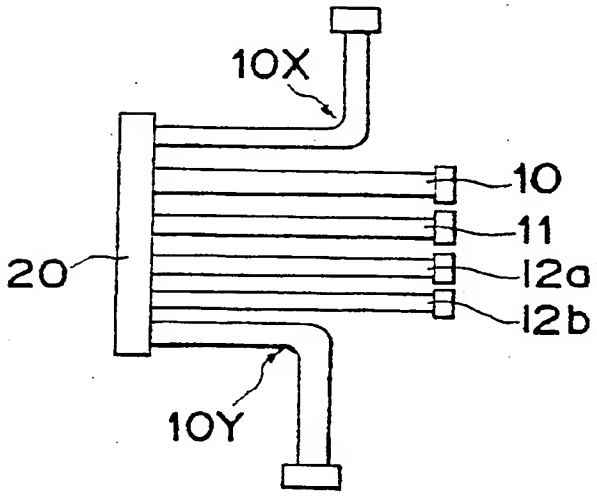

Fig. 8

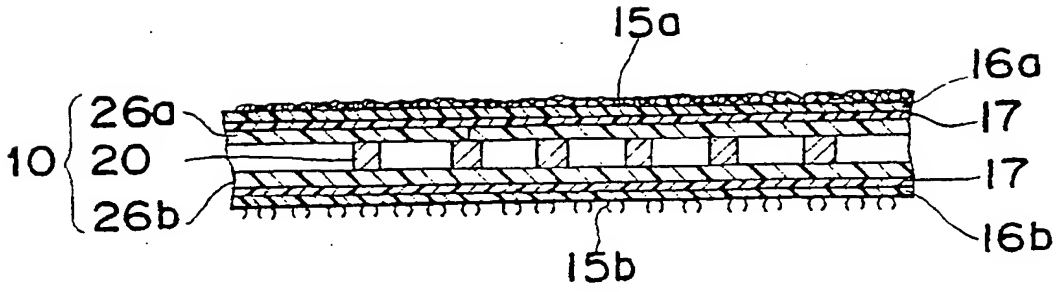

Fig. 9

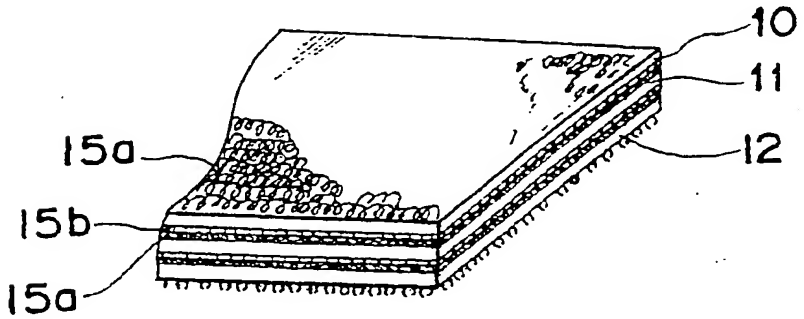

Fig. 10

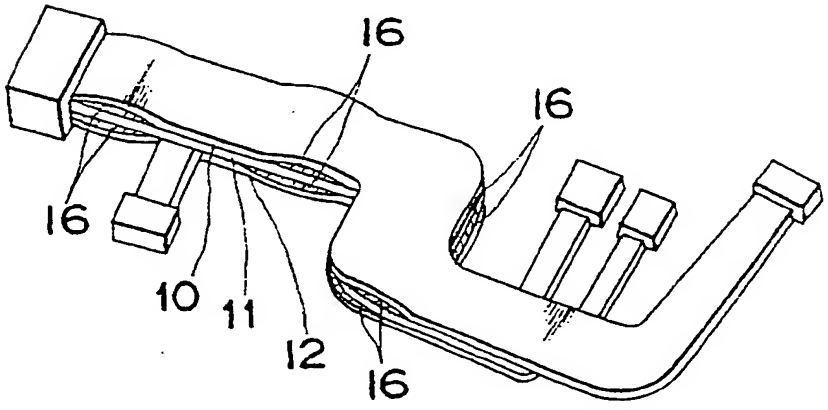

Fig. 11a

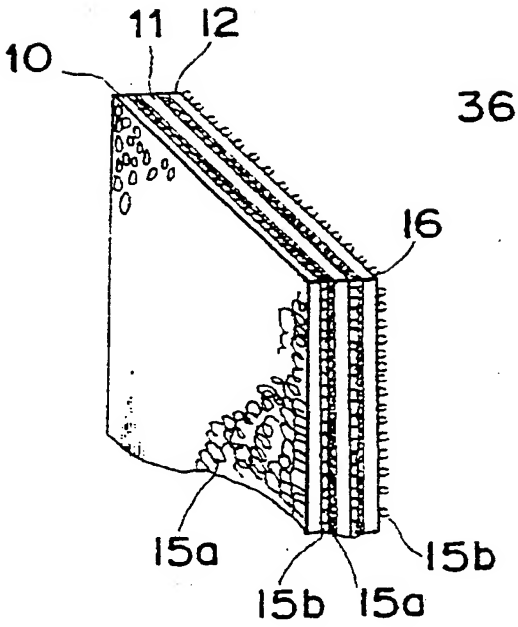

Fig. 11b

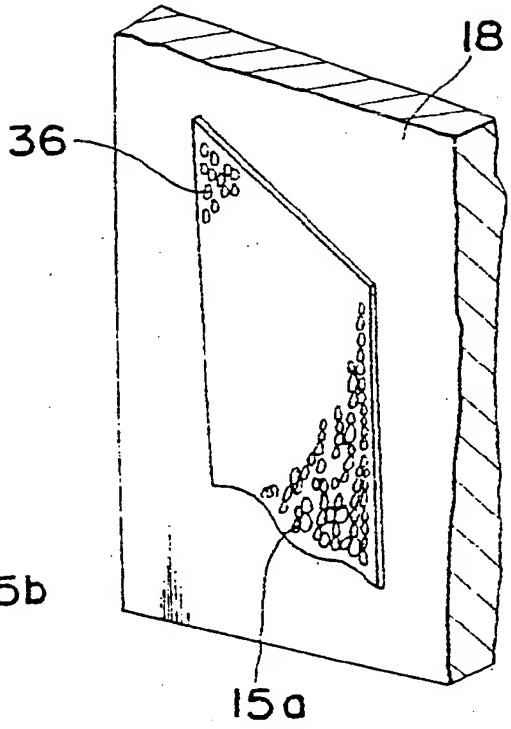

Fig. 12

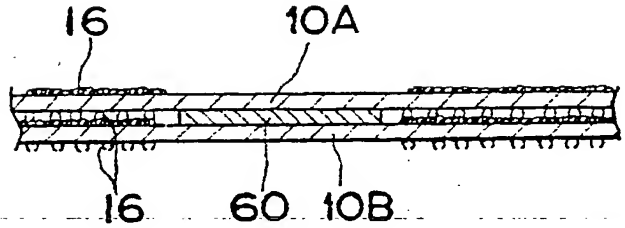

Fig. 13 PRIOR ART

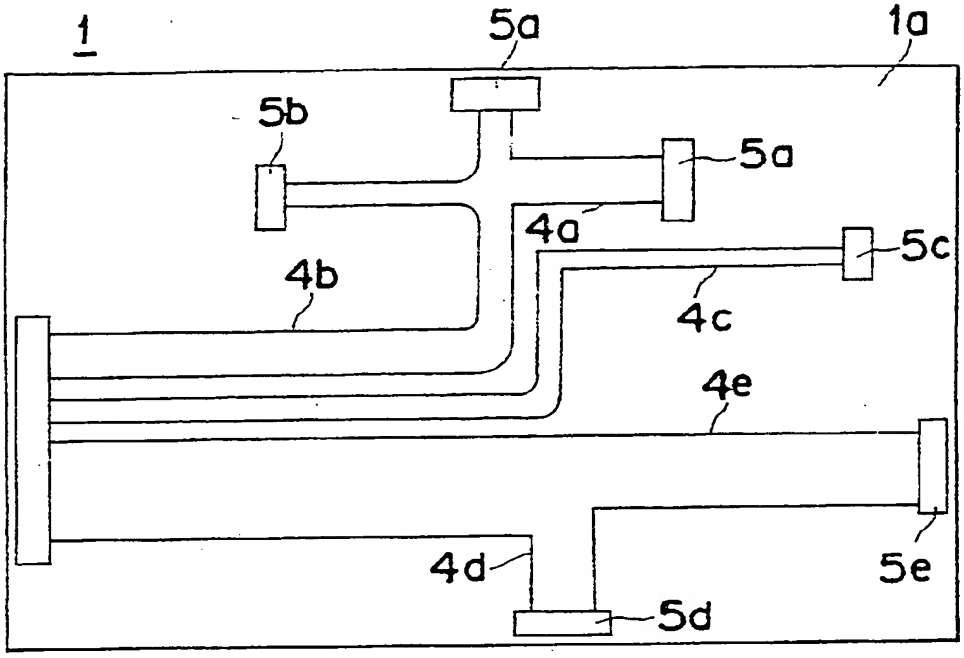

Fig. 14 PRIOR ART

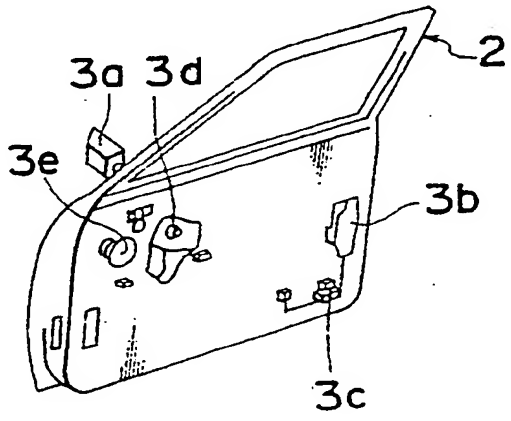

Fig. 15 PRIOR ART

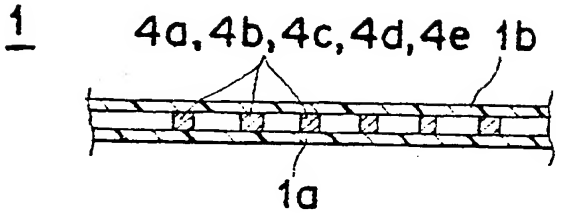

Fig. 16a PRIOR ART

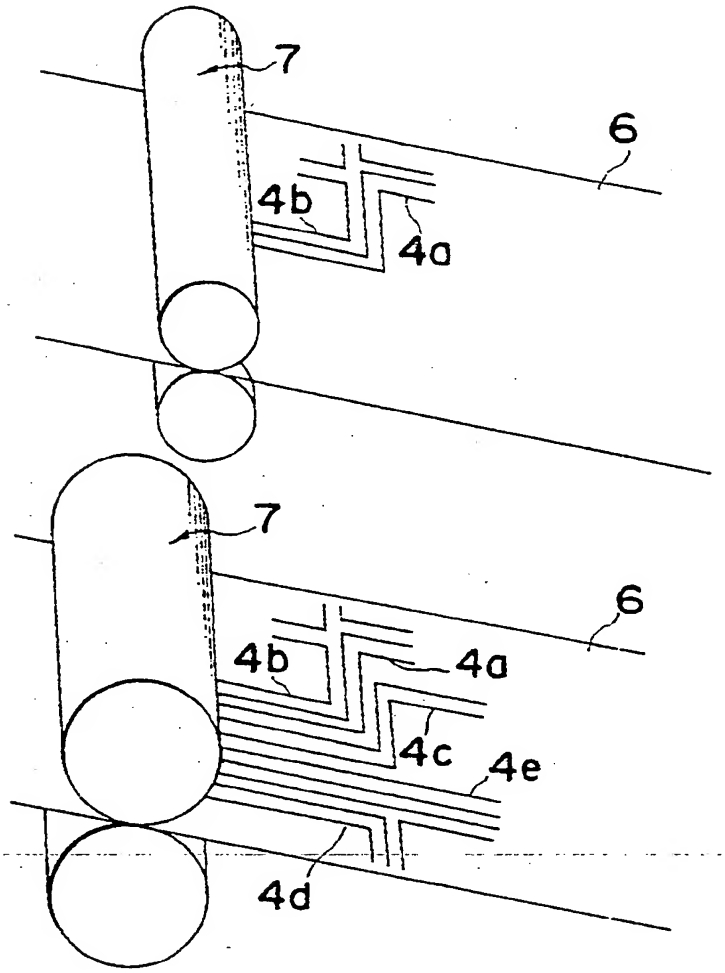

Fig. 16b
PRIOR ART

FLAT HARNESS ASSEMBLY

The present invention relates to a flat harness assembly comprising plural flat harnesses, each having circuits in a flexible printed circuit (FPC) formed by stamping copper foil, and relates particularly to an improvement of a flat harness used in the door harness of a motor vehicle whereby the required circuits differ according to the vehicle model.

Flat wiring harnesses 1 made from a FPC or flexible wiring circuit (FWC) as shown in Fig. 13 are commonly used as vehicle door harnesses today. These harnesses are applied to the frame of the vehicle door 2 as shown in Fig. 14, and the electrical components for the door mirror 3a, door lock 3b, step lamp 3c, power window 3d, door speakers 3e, and other electrical system components are connected to the power supply (not shown in the figures) through the plural circuits 4a, 4b, 4c, 4d and 4e of the flat harness 1.

The flat harness 1 is typically manufactured as a single integral component by stamping a copper foil sheet with a die (not shown in the figure) to form the plural circuits 4a - 4e, which are then sandwiched between insulating films

1a and 1b as shown in Fig. 15.

The end connector of each of the circuits 4a - 4e is connected to the conductor (not shown in the figures) of the corresponding electrical system component by means of a corresponding connector 5a - 5e.

The problem with this door harness, however, is that the required circuits differ according to the grade of the vehicle or the options selected for the vehicle. For example, power door mirrors 3a and door locks 3b may be standard equipment on all versions of a given model, and the circuits 4a and 4b connected to these electrical system components will therefore be common to all vehicles of that model. This same model, however, may also be available with optional power windows 3d, step lamps 3c, and door speakers 3e, and the circuits 4d, 4c and 4e connected to these electrical system components are not required when these options are not desired: i.e., these circuits are optional circuits.

Because the conventional flat harness 1 is manufactured by stamping all required plural circuits at one time from a single copper foil sheet, the size of the copper foil sheet is determined by the size required to provide all standard and optional circuits, and the die required to stamp this copper foil sheet is correspondingly large.

In other words, when the circuits required are the standard circuits (door mirror circuit 4a and the door lock

circuit 4b) plus the optional circuits (power windows 3d, step lamps 3c, and door speakers 3e), the copper foil sheet 6 and the roll dies 7 are used, as shown in Fig. 16b, to stamp the circuits 4a - 4e from the copper foil sheet 6. However, when the only standard equipment circuits are required, the circuits 4a and 4b shown in Fig. 16a are cut out from the copper foil sheet 6 using the roll dies 7.

As a result, when only the standard circuits are required, the lower half portion of the copper foil shown in Fig. 16a is wasted, and the rollers 7 must still be large even though only part of the roller is actually used for stamping.

Also, in the case where plural circuits 4a - 4e are provided in a single sheet, the area of the flat harness, or more specifically the width of the harness, increases, making it impossible to use the harness in certain installations.

When the circuits are made by stamping a copper foil sheet and the flat harnesses are manufactured separately for each vehicle model and model variation, there is a dramatic increase in the number of parts and part numbers, and managing all of the different flat harnesses becomes increasingly complex. As a result, these flat harnesses are usually not separately manufactured for each model variation but are manufactured in larger harness assemblies covering a wider selection of model variations. The flat harness for luxury cars and the highest grades available for any model often

incorporate all circuits stamped from a single copper foil sheet. As a result, the area required by the flat harness necessarily increases, and installation in confined areas becomes difficult or impossible.

According to the invention, a flat harness assembly for use in a vehicle comprises a first type of flat harness and optionally at least one of a second type of flat harness. The first type flat harness comprises: first and second flexible insulation films placed one over the other; and a common electrical line formed by stamping a copper foil and sandwiched between said first and second flexible insulation films, said common electrical line adapted for use commonly in all model vehicles. The second type flat harness comprises: third and fourth flexible insulation films placed one over the other; and an optional electrical line formed by stamping a copper foil and sandwiched between said third and fourth flexible insulation films, said optional electrical line adapted for use in a model of a vehicle with an option.

The optional circuits can be manufactured as a separate harness for each single circuit, or plural optional circuits that are always used together can be grouped in a single harness.

In this way, copper foil waste and size of the die required for copper foil stamping may be significantly reduced and thus reduce the cost of the finished flat harness.

The terminal connectors used to connect the harness to the power supply connectors are preferably provided in a single terminal set, thereby enabling a group of harnesses used together to be connected to the power supply using a single connector as though the discrete circuits were integrally formed.

When the flat harness of the invention is used as a door harness, the common circuits, e.g., the door lock and door mirror circuits, may be integrally stamped from a single copper foil sheet, and the optional circuits, e.g., the power window, door speaker, and step lamp circuits, may be separately stamped from another single copper foil sheet.

The size of the copper foil required to form the common circuits and the optional circuits is the minimum size providing sufficient area to form each of the circuits. For example, three sizes of copper foil, each of a different width, may be provided with each size used according to the size of the circuits stamped in a single operation.

The axial lengths of the roller dies used for stamping may also be set to the minimum required by the width of the corresponding copper foil sheet. For example, if the copper foil sheets are provided in three widths, the roller dies are also provided in three different axial lengths, thus

resulting in smaller individual rollers.

In addition, the length of copper foil required to form each circuit can be reduced to the minimum length required to form each circuit, and the length and diameter of the required roller die can be reduced accordingly. Because both the axial length and diameter of the roller die can thus be reduced, the size of the roller die can be reduced.

By separating the circuits as described above, the circuits formed by one-step die stamping of a copper foil sheet may be made smaller, the area of the required copper foil reduced accordingly, and the wasted copper foil significantly reduced.

Because the area of the required copper foil may be reduced, the size of the die corresponding to this copper foil area can also be reduced.

The present invention will become more fully understood from the detailed description given below by way of example only and from the accompanying diagrams wherein:

Figs. 1a, 1b and 1c are plan views of the separate flat harnesses used as door harnesses according to the first embodiment of the present invention,

Figs. 2a, 2b and 2c are diagrammatic views of the roller dies used to stamp the copper foil sheets to form the flat harnesses of Figs. 1a, 1b and 1c, respectively,

Fig. 3 is a partial cross sectional view of the flat harness shown in Fig. 1a,

Figs. 4a, 4b, 4c and 4d are plan views showing possible combinations of the flat harnesses shown in Figs. 1a, 1b and 1c,

Figs. 5a, 5b, 5c and 5d are plan views of the separated flat harnesses according to the second embodiment of the present invention,

Fig. 6 is a perspective view showing the layered arrangement of the flat harnesses,

Fig. 7 is a diagrammatic view showing an alternative layering scheme,

Fig. 8 is a cross section of a flat harness provided with adhesive cloths;

Fig. 9 is a perspective view of plural sheet type flat harnesses layered together by the adhesive cloths,

Fig. 10 is a perspective view of plural profile type flat harnesses layered together by the adhesive cloths,

Figs. 11a and 11b are perspective views of a layered flat harness assembly and a door panel on which the layered flat harness assembly is installed,

Fig. 12 is a cross sectional view showing placement of a protective spacer between the flat harnesses,

Fig. 13 is a plan view of a prior art flat harness,

Fig. 14 is a diagrammatic view of the electrical

system components provided in the vehicle door,

Fig. 15 is a partial cross-sectional view of the flat harness shown in Fig. 13, and

Figs. 16a and 16b are diagrammatic views showing the method of manufacturing the prior art flat harness.

The preferred embodiments of the present invention are described below with reference to the accompanying figures.

The flat harnesses shown in Figs. 1a, 1b and 1c are for a door harness used in a vehicle door 2 as shown in Fig. 14.

According to the first embodiment, the door harness is divided into a first harness 10 comprising common circuits 20, 21, 22 shown in Fig. 1a, and second and third harnesses 11 and 12 comprising optional circuits 23, 24 and 25 shown in Figs. 1b and 1c, respectively. The common circuits are provided in all models of the vehicle including standard and high grade models and optional circuits are provided in high grade models.

Referring to Fig. 1a, the first harness 10 comprises a door mirror circuit 21 for connection with the door mirror 3a (Fig. 14), a door mirror heater circuit 20 for heating the door mirror, and a door lock circuit 22 for connection with the door lock 3b (Fig. 14). The circuits 21, 22 and 23 are

formed by copper foil strips 20, 21 and 22 which are integrally cut out together during the stamping of the copper foil sheet. As the copper foil strips 20, 21 and 22 are stamped out from the copper foil sheet, they are placed on an insulation film 26a. Then, another insulation film 26b is placed over, so as to sandwich the copper foil strips 20, 21 and 22 between the two insulation films 26a and 26b, as shown in Fig. 3. At the end of each copper foil strips 21, 22 and 20 located within the insulation films 26a and 26b, connecters 30, 31 and 32 are provided.

According to a first type flat harness, referred to as a profile type, the two insulation films 26a and 26b are cut together, as shown by solid lines in Fig. 1a, along the profile or contour of the extending copper foil strips 20, 21 and 22 with a predetermined margin on both sides. Then, the connectors 30, 31 and 32 are connected to the ends of the copper foil strips 20, 21 and 22, respectively, in a known manner. Thus, the flat harness 10 of the first type has a configuration shown by the solid line.

According to a second type flat harness, referred to as a sheet type, the two insulation films 26a and 26b are cut together in U-shape only at the end portions of the copper foil strips 20, 21 and 22 so as to tongue out said end portions. Then, the connectors 30, 31 and 32 are connected to the ends of the copper foil strips 20, 21 and 22, respec-

tively, in a known manner. Thus, the flat harness 10 of the second type has a rectangular configuration as shown by a dash line.

The second harness 11 is for one optional circuit, e.g., for a step lamp circuit 23 having a connector 33 for connection with the step lamp 3c (Fig. 14). The second harness 11 has a similar structure to that of the first harness 10.

The third harness 12 is for two optional circuits, e.g., for a power window circuit 24 having a connector 34 for connection with the power window 3d (Fig. 14), and for a door speaker circuit 25 having a connector 35 for connection with the door speaker 3e (Fig. 14). The third harness 13 has a similar structure to that of the first harness 10.

The common circuits, specifically in the above example the circuits 20, 21, and 22 of the first harness 10, are formed from a single first size copper foil sheet using the roller die 50 shown in Fig. 2a. The first size copper foil sheet for the common circuits has a width W1 which is sufficient for stamping the copper foil strips for the common circuits, and a length L1 which is sufficient for forming one harness. Because the length L1 is relatively short, the radius R1 of the roller die 50 used for stamping the circuits 20, 21 and 22 is correspondingly small. The axial length of the roller die 50 is also the minimum length required to cover

the width W1 of the copper foil.

The optional circuit 23 provided in the second harness 11 is similarly formed from a single second size copper foil sheet using another roller die 51 shown in Fig. 2b. The width W2 and length L2 of the second size copper foil sheet are sufficient to stamp out the optional circuit 23. Thus, the length and radius R2 of the roller die 51 used for the second harness 11 are similarly determined by the width W2 and length L2 of the second size copper foil sheet.

The optional circuits 24 and 25 of the third harness 12 are similarly formed from a single third size copper foil sheet using another roller die 52 shown in Fig. 2c. The width W3 and length L3 of the third size copper foil are sufficient to stamp out the optional circuits 24 and 25. Thus, the length and radius R3 of the roller die 52 are determined by the width W3 and length L3 of the third size copper foil sheet.

Therefore, the relationship between the widths of the first, second and third size copper foil sheets required to form the circuits is W1 > W3 > W2 in this example, and three copper foil sheets of differing widths are used for stamping. The relationship between the lengths of the first, second and third size copper foil sheets is L3 > L2 > L1, and the relationship between the radii of the roller dies is R1 < R2 < R3.

Note that the width W1 of the first size copper foil sheet, which is widest, is approximately half that of the copper foil sheet 6 shown in Fig. 16a. As a result, the size of the largest roller die used to stamp the first size copper foil sheet of width W1 is also approximately half that of the conventional roller die.

Referring to Figs. 4a-4d, various combinations of the first, second, and third harnesses 10, 11, and 12 are shown, depending upon the electrical system components installed in the vehicle. In the examples shown in Figs. 4a-4d, sheet type flat harnesses are used.

Fig. 4a shows a case of a standard model vehicle with no option. In this case, the only electrical system components installed in the door 2 are the door mirrors 3a and door locks 3b. Thus, only the first harness 10, which provides the required common circuits, is used as the door harness. The first harness 10 is taken and the ends of the copper foil strips located at the edge of the insulation films 26a and 26b are connected to a single connector 40 such that terminals (not shown) in the connector 40 are electrically connected to the ends of the copper foil strips in a known manner.

Fig. 4b shows a case of a first middle grade model vehicle with an option of the step lamp 3c. In this case the electrical system components installed in the door 2 are the

door mirror 3a, door lock 3b and step lamp 3c. Thus, the first harness 10 and the second harness 11 are combined and used as the door harness. The first and second harnesses are taken together as shown in Fig. 4b, so that the ends of the copper foil strips terminating at the edge of the insulation films are aligned. The aligned ends are connected to a single connector 41 in a similar manner to connector 40.

Fig. 4c shows a case of a second middle grade model vehicle with options of the power window 3d and door speakers 3e. In this case, the electrical system components installed in the door 2 are the door mirror 3a, door lock 3b, the power window 3d and the door speakers 3e. Thus, the first harness 10 and third harness 12 are combined as the door harness. The first and third harnesses are taken together as shown in Fig. 4c, so that the ends of the copper foil strips located at the edge of the insulation films are aligned. The aligned ends are connected to a single connector 42 in a similar manner to connector 40.

Fig. 4d shows a case of a high grade model vehicle with full complement of electrical system components is used, i.e., the door mirror 3a, door lock 3b, step lamp 3c, power window 3d, and door speakers 3e are all installed in the door 2. In this case, the first, second, and third harnesses 10, 11 and 12 are combined as the door harness. The first, second and third harnesses are taken together as shown in Fig. 4d,

so that the ends of the copper foil strips located at the edge of the insulation films are aligned. The aligned ends are connected to a single connector 43 in a similar manner to connector 40.

In the case where plural flat harnesses are used, a portion of the harnesses may overlap with each other, such as shown in Figs. 4b and 4d. In such a case, it is possible to provide adhesive member, such as magic tapes, to prevent the harnesses from being separated. This is further described in detail later in connection with Figs. 8-12.

As will be seen from the above description, a flat harness according to the first embodiment of the present invention can reduce the copper foil area required to form the requisite circuits because the plural circuits are divided into common circuits that are always used and optional circuits that are used only as required. It is therefore possible to significantly reduce the waste resulting from the copper foil stamping operation, and thus reduce the cost of the finished harness.

The axial length and diameter of the die used for copper foil stamping are also reduced because the area of the stamped copper foil is reduced. The cost of die manufacture and the space required for die installation can thus both be reduced because the die is smaller.

A flat harness according to the second embodiment

of the present invention is described below with reference to Figs. 5a-7.

Referring to Figs. 5a, 5b, 5c and 5d, flat harnesses 10, 11, 12a, and 12b are shown, respectively, in which the flat harnesses 10 and 11 are the same as those shown in Figs. 1a and 1b. The flat harnesses 12a and 12b are for the two optional circuits 24 and 25, i.e., for the power window circuit 24 and for the door speaker circuit 25. Thus, according to the second embodiment, the optional circuits are separately provided in separate flat harnesses.

Also, according to the second embodiment, the color of the insulating film is different in each of the flat harnesses 10, 11, 12a and 12b. For example, the color of the insulating film 26a and/or 26b may be red for the first flat harness 10. Similarly, the color of the insulating film may be blue for the next flat harness 11, yellow for the next flat harness 12a, and green for the last flat harness 12b. Thus, the flat harnesses of different circuits can be easily distinguished.

The color of the insulating film is produced by mixing a pigment with the insulating film resin, and is preferably a transparent red, blue, yellow, or green.

Note that tape of a different color can also be applied to an easily identifiable location on the edge of the insulating film for color coding.

The flat harnesses 10, 11, 12a and 12b of the profile type, can be combined in a single layered package connector as shown in Fig. 6. The flat harnesses 10, 11, 12a and 12b have their copper foil strips connected to separate terminals in a common connector 20.

When it is necessary to fold a flat harness as shown in Fig. 7, the folded flat harnesses 10X and 10Y can be layered with the other flat harnesses by placing them outside the other non-folded flat harnesses as shown.

When the flat harnesses 10, 11, 12a, 12b are layered, each individual harness can be easily identified for the separate electrical systems by the color coding, and selection and placement errors can be easily prevented.

By separating the flat harnesses by electrical system in term of the optional circuit, the area, and specifically the width, of each flat harness can be further reduced. The separate flat harnesses can also be installed in the same area as a single combined flat harness by layering the flat harnesses together. As a result, installation to confined spaces is possible, and less installation space is required.

Selection and placement errors can also be prevented because the color of the flat harness insulating film is determined by the electrical system to which the flat harness is connected.

Unnecessary circuits are also eliminated from the flat harnesses because only the flat harnesses having the required circuits are combined in a single connector, and copper foil waste can therefore be eliminated compared with using a single flat harness comprising all circuits possibly required in all models and variations.

Referring to Figs. 8-12, an arrangement for securing plural flat harnesses together in layers is shown.

As shown in Fig. 8, each of the flat harnesses, such as a sheet type flat harness 10 has adhesive cloths 16a and 16b on both of the opposite outer surfaces thereof. The adhesive cloth 16a implanted with many loop-like, or female, engaging members 15a is attached with adhesive 17 to the complete or portion outside surface of one insulating film 26a, and similarly an adhesive cloth 16b implanted with many hook-like, or male, engaging members 15b is attached with adhesive 17 to the complete or portion outside surface of one insulating film 26b.

The adhesive cloths 16a and 16b, generally designated as 16, may be the Velcro® or any other similar cloths. Note also that instead of the adhesive cloth 16 and adhesive 17, a double-sided adhesive tape can be used.

In addition, the adhesive cloth 16 may be attached at only essential spots rather than to the entire surface of the both insulating films.

Other flat harnesses 11 and 12 are provided similarly with the adhesive cloths on their opposite surfaces.

Plural sheet type flat harnesses 10, 11, and 12, each provided with the adhesive cloths 16 as described above, are layered together as shown in Fig. 9.

Specifically, the plural flat harnesses 10, 11 and 12 are layered such that the female engaging members 15a on the first side of the second flat harness 11 engage the male engaging members 15b on the second side of the first flat harness 10, and the third flat harness 12 is similarly attached to the second flat harness 11. The three flat harnesses 10, 11, and 12 are thus secured to each other in sequential layers forming a single harness assembly.

It is to be noted that while in the above description the adhesive cloth 16a attached to the first side of the flat harness 10 is implanted with female engaging members 15a and the adhesive cloth 16b on the other side is implanted with male engaging members 15b, this sequence may be varied. Specifically, it is also possible to use an adhesive cloth 16a with female engaging members 15a on both sides of one flat harness 10, and to use an adhesive cloth 16b with male engaging members 15b on both sides of another flat harness 11. In this case, the flat harness with female engaging members 15a in the adhesive cloth 16a on both sides thereof may be placed between other flat harnesses of which the adhesive

cloth 16b has only male engaging members 15b.

Referring to Fig. 10, the profile type flat harnesses 10, 11 and 12 are shown with the adhesive cloth 16 applied at essential contact points.

Referring to Figs. 11a and 11b, an adhesive cloth 36 is also applied to a door panel 18 so that the layered assembly of flat harnesses 10, 11 and 12 described above can be fastened to the door panel 18 by simply engaging the adhesive cloth 16 on the flat harness 10 with the adhesive cloth 36 on the door panel 18. When the sheet type flat harnesses are applied to the door panel 18, such flat harnesses will serve as a protector. In the case where a protector sheet is already installed on the door panel 18, the adhesive cloth 36 can be applied to the protector and the layered assembly of the flat harnesses can be applied on the protector.

The adhesive cloth 36 affixed to the body panel 18 is preferably attached using a double-sided adhesive tape (not shown in the figure) because of its easy handling and use.

When a adhesive cloth 36 with female engaging members 15a is attached to the door panel 18, the side of the flat harness 10 with male engaging members 15b in the adhesive cloth 16 is applied to the door panel 18. This causes the opposing male and female engaging members to engage, easily holding the flat harness 10 to the door panel 18.

When the adhesive cloth 16 with engaging members is applied only at selected spots on the flat harnesses 10 and 11, gaps occur between the flat harnesses 10 and 11 where there is no adhesive cloth 16 as shown in Fig. 12. Flexing and sagging of the flat harnesses can be prevented in this case by inserting a protective sheet 60 between the harnesses.

According to the embodiment shown in Figs. 8-12, the flat harnesses can be secured together in layers with extreme ease because an adhesive cloth implanted with many thread-like male and female engaging members is attached to both sides of each flat harness.

Furthermore, by attaching a similar adhesive cloth to the door panel or protector, a flat harness having a corresponding adhesive cloth can be easily secured to the door panel or protector.

When the sheet type flat harnesses are used, the adhesive cloth having engaging members and attached to the outside surfaces of the thin insulating films coating the conductors also functions as a protective coating that also helps increase the mechanical strength of the flat harness. Damage to the conductor and shorting caused by applied external forces can thus be prevented by the protective coating. More specifically, the conductor can be protected without providing a separate protective member.

Note also that application of a flat harness

according to the present invention is not limited to door harness applications, and can be effectively applied in a variety of harnesses.

CLAIMS

1. A flat harness assembly for use in a vehicle comprising:

I. a first type flat harness comprising:

first and second flexible insulation films placed one over the other; and

a common electrical line formed by stamping a copper foil and sandwiched between said first and second flexible insulation films, said common electrical line being adapted for use commonly in all model vehicles; and

II. optionally at least one second type flat harness comprising:

third and fourth flexible insulation films placed one over the other; and

an optional electrical line formed by stamping a copper foil and sandwiched between said third and fourth flexible insulation films, said optional electrical line being adapted for use in a model of a vehicle with an option.

2. A flat harness assembly according to Claim 1, further comprising:

III. a common connector for holding said first and second type flat harnesses together at ends of said common and optional electrical lines and for external electric connection with said electrical lines.

3. A flat harness assembly according to claim 1 or claim 2, wherein said second type flat harness has plural optional electrical lines for plural optional devices.

4. A flat harness assembly according to claim 1 or claim 2, wherein said second type flat harness has an optional electrical line for only one optional device.

5. A flat harness assembly according to any preceding claim having a plurality of said second type flat harnesses each having different color coding provided on at least one of said third and fourth flexible insulation films.

6. A flat harness assembly according to any preceding claim, wherein at least one of said first and second type flat harnesses is provided in a form of a sheet.

7. A flat harness assembly according to any preceding claim, wherein at least one of said first and second type flat harnesses is provided in a form of a profile of said electrical line.

8. A flat harness assembly according to any preceding claim, further comprising:

first and second adhesive cloths provided on outside surfaces of each of said flat harnesses, each adhesive cloth having many engaging members for securing said flat harnesses together in layers.

9. A flat harness assembly according to Claim 8, wherein said first and second adhesive cloths are provided on substantially all outside surfaces of said each of said flat harnesses.

10. A flat harness assembly according to Claim 8, wherein said first and second adhesive cloths are provided at portions of all outside surfaces of said each of said flat harnesses.

11. A flat harness assembly according to Claim 10, further comprising a protective sheet inserted between said flat harnesses at portions other than where said first and second adhesive cloths are provided.

12. A flat harness assembly according to any one of claims 8 to 11, further comprising a third adhesive cloth provided on a vehicle panel for securing said flat harnesses layers on said vehicle panel.

13. A flat harness assembly substantially as described herein with reference to and as illustrated in Figures 1 to 12 of the accompanying drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report) -26-	Application number GB 9403080.6
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Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)	Documents considered relevant following a search in respect of Claims :- 1 to 13

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Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 1523291	(KABELWERKE) Figure 1	1 & 6
X	GB 1413518	(CAVIS-CAVETTI) All figures	1 & 6
X	GB 1177275	(FORD MOTOR COMPANY) All figures	1,2 & 6

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